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ABSTRACT

Entrance requirements and a weeding process conducted by way of a pre-engineering mathematics program act as a restriction on the number of students graduating with engineering degrees. This study examined the relationship between entrance requirements and the degree of student success upon graduation, as well as the validity of the weeding effect of the mathematics program. Statistical relationships were developed between such factors as Scholastic Aptitude Test (SAT) scores, mathematics grades, and graduating grade point averages (GPA). It was found that SAT verbal scores, SAT total scores, and grades in college mathematics are statistically related to graduating GPA. However, the data analysis shows that SAT math scores are not related to the graduating GPA. The analysis concludes that SAT math scores, verbal scores, and the total SAT scores are not related to the student's performance in college mathematics. Recommendations include a lowering of the minimum SAT requirements in mathematics for admission to the engineering college. (Author/LBH)

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A STUDY ON THE VALIDITY OF ADMISSIONS POLICY AS APPLIED TO THE SCHOOL OF ENGINEERING AT AN URBAN UNIVERSITY

BY

FRANCIS J. COSTELLO Ed.D
NOVA UNIVERSITY
UNIVERSITY OF NEW HAVEN
1977

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ABSTRACT

A Study On The Validity of Admissions Policy
As Applied To The School of Engineering
At An Urban University

Entrance requirements, and a weeding process conducted via a pre-engineering mathematics program act as a restriction to the number of students that graduate with engineering degrees.

The research paper examined the relationship between entrance requirements and the degree of student success upon graduation. Also, the validity of the weeding effect of the mathematics program was investigated.

Statistical relationships were developed between such factors as SAT scores, mathematics grades, and graduating grade point averages. Several hypotheses were tested via correlation analysis.

The study found that SAT verbal scores, SAT total scores and grades in college mathematics are statistically related to graduating grade point averages. However, the data analysis showed that SAT math scores were not related to the graduating grade point average. Also, the analysis concluded that SAT math scores, verbal scores and the total SAT scores were not related to the student's performance in college mathematics.

Recommendations included a lowering of the minimum SAT requirement in mathematics for admission to the engineering college.

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Recommendations included a lowering of the minimum SAT requirement in mathematics for admission to the engineering college.

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INTRODUCTION

In June of 1975, the University of New Haven graduated 290 students who completed bachelor degree requirements in the day undergraduate schools. Thirty of the 290 students were from the day undergraduate program in the engineering school. Relative to the facilities provided by the University for engineering study, and considering the rewards associated with an engineering profession, few students manage to meet the requirements for the engineering degree.

There are at least two factors associated with the fact that only 10% of the graduates of the University are engineers. The first factor is the requirements for admission to the pre-engineering program. The second factor is the weeding-out procedure accomplished by the mathematics sequence in the pre-engineering curriculum. There is an acknowledgement by the admissions department at the University of New Haven, that admission to the pre-engineering curriculum is based primarily on the potential student's SAT scores with a minimum of 400 on the student's mathematics score as a pre-requisite to admission. Also, a minimumof 700 on the total SAT (verbal and math) is used as a cut-off.

The mathematics requirements in the pre-engineering program amount to an entrance requirement to the major disciplines in the School of Engineering. It is well recognized, by both students and faculty at the University of New Haven, that many students flunk pre-engineering mathe-

matics or do so poorly that they withdrew from the engineering major. The question is whether or not the engineering school's facilities and faculty, as an institutional and community resource, are being underutilized due to admission policy and weeding procedures that do not establish a valid criteria for student success in the major School of Engineering.

The purpose of this investigation is to determine whether or not there is a relationship between the SAT entrance requirements to pre-engineering and the degree of student success in completing the bachelor's requirement for the engineering degree at the University of New Haven.

Also this investigation will examine the validity of the weeding process in pre-engineering that is accomplished by the mathematics program at the University . The relationship between student performance in the mathematics program and the degree of student success in completing the bachelor's requirement as prescribed by the University's School of Engineering will be examined.

This investigation will address the following questions:

Relationship 1

What effect does SAT mathematics scores have on the graduating GPA of engineering students?

Independent Variable: SAT mathematics scores

Dependent Variable: GPA

Relationship 2

What effect does SAT verbal scores have on the graduating GPA of engineering students?

Independent Variable: SAT verbal scores

Dependent Variable: GPA

Relationship 3

What effect does total SAT scores have on the graduating GPA of engineering students?

Independent Variable: Total SAT scores

Dependent Variable: GPA

Relationship 4

What effect does grades in pre-engineering mathematics have on the graduating GPA of engineering students?

Independent Variable: Mathematics grades

Dependent Variable: GPA

Relationship 5

What is the combined effect of total SAT scores and grades in mathematics on the graduating GPA of engineering students?

Independent Variable: 1) Total SAT scores
2) Grades in mathematics

Dependent Variable: GPA

BACKGROUND AND SIGNIFICANCE

The traditional educational policy systems in our colleges and universities are insulated against progressive change by the lever and trap door that is operated via the admission policy. Only those students who can fit the traditional pattern of our higher educational system are allowed to enter. Students who don't fit are rejected.

Admission to colleges and universities is typically based on the potential student's past academic performance and test scores that are intended to reflect academic ability. An admission policy is a forcasting model that is intended to predict the potential student's degree of success relative to at least the first 25% of college work at the particular institution.

Admission models that emphasize past grades and test scores, such as SAT scores, are becoming less reliable than in the past (1). The cause of this loss of reliability has to do with a national de-emphasis of the

(1) Nicholson, E. The Admission Index as a Prediction of Freshman GPA U.S. Dept. of H.E.W. (Brown University) Feb. 1971

grade-getting potential of students. Also, there is research evidence that classroom grades and test scores do not correlate with adult success (1).

Nevertheless, there is considerable evidence that many colleges rely heavily on test scores relative to admissions (2).

SAT scores may not identify the ability of students. The tests may reward rote memory or persistance in taking tests rather an intellectual power. The basic requirement of an SAT total of 700 with at least 400 in mathematics may only serve to avoid tragic misfits (3).

A study of the Educational Testing Service showed that predictions of student's college performance, based on SAT scores, were inaccurate. Relative to students who were expected to do "C" work, 30% did "B" work or better, and 10% flunked out of school (4).

(1) Hoyt's Review, 1065 and Baird, 1968 - as discussed by Nicholson, E. in The Admission Index as a Prediction of Freshman GPA U.S. Dept. of H.E.W. (Brown University) Feb. 1971

(2) Sulkin, S. Complete Planning for College p. 49 McGraw Hill

(3) Thresher, B. A. College Admissions and Public Policy College Entrance Examination Board, 1966

(4) ibid: Relative to a discussion by Thresher in College Admissions and Public Policy College Entrance Examination Board, 1966

Recent studies by Chase (1) show that SAT verbal and mathematics scores account for only 14 or 15%, respectively, of the variance in first quarter grades of college students. By multiple correlation, the combined effect of verbal and mathematic SAT scores accounted for only 18% of the variance of college grades. An interesting point confirmed by Chase is the proposition that SAT scores are more valid as a predictor of women's college grades than men's college grades. Women's SAT scores (combined verbal and math) account for 23% of the variance of college grades received by women. This was established by Perry, et al, in studies made at the University of Minnesota in 1971 (1). Perry found a high correlation between SAT scores and college performance when the SAT scores are combined (via multiple correlation) with the student's high school record and scores on the Academic Achievement tests. According to Perry's research, as high as 43% of the variation in the students' college grades can be explained via the combined effect of the student's high school record, his SAT scores and his performances on the academic achievement tests. This indicates a multiple correlation factor of .66 which is fairly high and I assume that the sample sizes would withstand a T test on the validity of $T = 0$.

(1) Chase, C. I., et al, Predicting Success for College Freshman
Indiana University, Bureau of Ed. Statistics, 1973

Of the various predictors used by Perry, the student's high school rank was found to be the best single predictor of college performance (A). In spite of some hesitation, Perry supported the SAT in combination with A.C.T. and H.S.R. as a valid predictor of college grades.

Perry's work confirms previous work done by Wilson at the Princeton Research Center in 1970 (1). Wilson's work established the proposition that HSR was a more reliable predictor of college grades than SAT scores. Wilson presents strong evidence that SAT scores are of little value in predicting college grades, even when they are combined with HSR and the CEEB achievement average.

Using the HSR and CEEB achievement rank, Wilson found a correlation factor of .5 (avg.) relative to average grades of freshmen. When the SAT scores of the students were added to the HSR and CEEB rank, the correlation to freshmen scores was increased to .51, which is truly an insignificant change. On that basis, Wilson recommended that prediction formulas be based solely on factors other than SAT scores.

(A) Footnote A Perry's discussion can be found on page 7 of Predicting College Grades

(1) Wilson, K. M. Contribution of SAT's to Prediction of Freshman Grades, Princeton Research Center, Princeton University, 1970

Admission officers at the University of New Haven report that potential engineering students are not accepted or rejected solely on the basis of SAT scores. Other qualifications are intended to play an important part in the acceptance or rejection procedure. The writer has doubt that "other" qualifications have significant weight relative to the SAT score. Many institutions claim that SAT scores, along with other significantly weighted qualifications are used for granting admission, but studies by Wing & Walloch, 1971, (1) show that the "other" qualifications are given very light weight in the admissions procedure.

Notable researchers have come to the conclusion that aptitude tests, such as the scholastic aptitude test, are a valid and reliable measurement of student success, both in college, and in life. Ghiselli (1966) (2), presented evidence, based on extensive research, that relate scores on general intelligence tests to job success. A study in 1972 by Jensen (3) confirms a correlation between intelligence tests and occupational status as well as scholastic performance.

(1) Wing & Wallach College Admissions and the Psychology of Talent Holt Rinehart, 1971

(2) Ghiselli, E. E. The Validity of Occupational Aptitude Tests Wiley, 1966

(3) Jensen, A. R. The Heritability of Intelligence The Saturday Evening Post, 1972

However, there also has been a considerable amount of criticism directed toward the aptitude and intelligence tests. Thorndike and Hagen (1959) (1), found that correlations between aptitude tests and occupational success showed that the tests were without validity. Elton and Shevel in 1969 found no relationship between scholastic aptitude scores and later accomplishments of college students.

A strong argument presented by McClelland (3) in 1971 suggests that IQ tests and aptitude tests as we know and use them today, are valid and reliable predictors of academic success only, and are poor predictors of a person's real ability.

A reasonable research of the literature did not produce previous research that related pre-engineering mathematics grades to graduating GPA of engineering students.

(1) Thorndike and Hagen 10,000 Careers, Wiley 1959

(2) Elton and Shevel An Analysis of Talent, American College Testing Program, Iowa City, 1969

(3) McClelland, D. C. Testing For Competence Rather than Intelligence Educational Testing Service, Princeton, New Jersey, 1971

SUMMARY

Authorities in the field of educational research are not in agreement as to the worth and proper use of SAT scores relative to college students. Some report strong correlations between SAT scores and academic performance in college, while others find no correlation. A relationship between SAT scores and success in life, while confirmed by some, is denied by others.

The value and usefullness of SAT scores as a criteria for admission to the School of Engineering at the University of New Haven will be determined via this practicum.

SIGNIFICANCE OF THE STUDY

Studies that relate SAT scores to student performance in the engineering college have not previously been made at the University of New Haven. The results of this study will, therefore, be of significant interest to the admissions officers and administration officers at the University of New Haven.

If SAT scores are unrelated to the performance of engineering students, it seems reasonable that the entrance requirements, which are based primarily on SAT scores, are not realistic. Moreover, the SAT

requirements may eliminate students from the engineering profession who would, if given the opportunity, successfully complete the requirements for the engineering degree.

This study may force a re-definition of entrance requirements to the School of Engineering.

There has been, at the University of New Haven, general criticism of the grades issued to pre-engineering students by the mathematics department. Many students flunk Calculus I and Calculus II, and drop the engineering major. If this study shows that there is no relationship between college math scores and graduating GPA, the criticism is apparently justified. However, if there is a correlation between the college math scores and the graduating GPA of engineering students, as the writer predicts, publication of the facts should create a better understanding of the grading system used by the mathematics department. Moreover, a relationship between the students' math grades and his subsequent performance in the engineering college will provide a concrete basis for early counseling of students who receive D grades in mathematics. The attitude at this time is that the grades are much too critical of student performance. The criticism may be well justified since the mathematics classes are

conducted in a very traditional manner that subscribes to the most traditional students. However, if the student is to enter a very traditional engineering school, it seems appropriate that mis-fits be weeded out before they enter the engineering classroom. Once again, the purpose of this study is to determine the validity of the mathematics program's weeding process, relative to subsequent student success at a specific school of engineering. The fact that better teaching methods would improve student performance in mathematics is another matter.

PROCEDURES

Data will be extracted from the Registrar's files relative to 30 engineering day division students, all of whom graduated in June of 1975. The population represents the entire day division graduating class. The data that will be taken from the student files will include:

A) SAT score, verbal section,

B) SAT score, math section,

C) grades in college mathematics,

D) GPA at graduation.

A Pierson Linear correlation or a multiple correlation will be used to statistically accept or reject the following hypotheses:

Hypothesis 1

Mathematics scores on SAT tests are not related to the graduating GPA of engineering students.

Independent variable:	SAT math scores
Dependent variable:	Graduating GPA
Sample size:	30
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 2

Verbal scores on SAT tests are not related to the graduating GPA of engineering students.

Independent variable:	SAT verbal scores
Dependent variable:	Graduating GPA
Sample size:	30
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 3

Total SAT scores are not related to the graduating GPA of engineering students.

Independent variable:	Total SAT scores
Dependent variable:	Graduating GPA
Sample size:	30
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 4

Grades in college mathematics are not related to the graduating GPA of engineering students.

Independent variable:	Grades in college mathematics
Dependent variable:	Graduating GPA
Sample size:	30
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 5

The combined effect of SAT math scores and grades in college mathematics are not related to the graduating GPA of engineering students.

Independent variable:	SAT math. scores Grades in college math.
Dependent variable:	Graduating GPA
Sample size:	30
Statistical method:	Multiple correlation analysis
Statistical test:	t statistic, to 98% confidence

Hypothesis 6

Mathematics scores on SAT tests are not related to the students' grades in college mathematics.

Independent variable:	SAT math scores
Dependent variable:	Grades in college math
Sample size:	30
Statistical method:	Pierson Linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 7

Total SAT scores are not related to the students' grades in college mathematics.

Independent variable:	Total SAT scores
Dependent variable:	Grades in college math
Sample size:	30
Statistical method:	Pierson Linear correlation
Statistical test:	t statistic, to 98% confidence

Hypothesis 8

Verbal scores on SAT tests are not related to the students' grades in college mathematics.

Independent variable:	SAT verbal scores
Dependent variable:	Grades in college mathematics
Sample size:	30
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

The outcome of the various statistical tests will be reported in the results section of this study.

LIMITATIONS

This study is limited to the University of New Haven's School of Engineering, its graduating seniors in June of 1975, and the mathematics as taught at the University during the four years prior to 1975.

No attempt to generalize the results to other schools can be made. Also, the study is pertinent to the time the data was taken. Data on a number of graduating classes, perhaps over a five year period would be necessary to establish a long term characteristic for the University.

Definition of Terms

1) SAT mathematics scores: The student's scores on the math portion of the Scholastic Aptitude Test.
2) SAT verbal scores: The student's score on the verbal portion of the Scholastic Aptitude Test.
3) Graduating GPA of engineering students: The final grade point average of graduating engineering students at the University of New Haven. A GPA of 4.0 is equivalent to straight A work, 3.0 is B, and 2.0 is C work.
4) College mathematics grades: The average grade earned by pre-engineering students in Finite Mathematics, Calculus I, Calculus II, Calculus III, and Differential Equations. Straight A work would give a 4.0 average.

RESULTS

Records on the thirty graduating engineering students of June, 1975 were taken from the University's Registrar's files. Of the thirty students, three were found to be transfer students who did not take their mathematics at the University of New Haven. It was decided to eliminate them from the study, thereby reducing the sample size to 27. Also, SAT scores for five students were missing from the records, therefore the sample size relative to correlations involving SAT scores will be 22.

The results are treated relative to each hypothesis stated in the procedures, on page .

Hypothesis 1

Mathematics scores on SAT tests are not related to the graduating GPA of engineering students:

Independent variable:	x = SAT math scores
Dependent variable:	y = Graduating GPA
Revised Sample size:	22
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

$x = 11975$
$y = 66.84$
$x^2 = 6653990$
$y^2 = 205.3$
$xy = 36608$
r = correlation factor
$n = 22$, sample size

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]\}^{1/2}} = \frac{4967}{12098} = .41$$

$$t = r\left\{\frac{(n-2)}{(1-r^2)}\right\}^{\frac{1}{2}} = .41\left\{\frac{20}{.83}\right\}^{\frac{1}{2}} = .41\ (4.90) = 2.01$$

A t of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we accept the hypothesis:

Mathematics scores on SAT tests <u>are not</u> related to the graduating GPA of engineering students.

<u>Hypothesis 2</u>

Verbal scores on SAT tests are not related to the graduating GPA of engineering students:

Independent variable:	x = SAT verbal scores
Dependent variable:	y = Graduating GPA
Revised Sample Size:	22
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

$x = 9652$

$y = 66.84$

$x^2 = 4485488$

$y^2 = 205.3$

$xy = 29844.6$

r = correlation factor

n = 22, sample size

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\left\{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]\right\}^{\frac{1}{2}}} = \frac{11,428,32}{16447.4} = .69$$

$$t = r\left\{\frac{n-2}{1-r^2}\right\}^{\frac{1}{2}} = .69\left\{\frac{20}{.52}\right\}^{\frac{1}{2}} = 4.27$$

A t value of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we reject the hypothesis:

Verbal scores on SAT tests are related to the graduating GPA of engineering students.

Hypothesis 3

Total SAT scores are not related to the graduating GPA of engineering students:

Independent variable:	x = Total SAT scores
Dependent variable:	y = Graduating GPA
Revised Sample Size:	22
Statistical method:	Pierson linear correlation
Statistical test:	t statistic, to 98% confidence

$x = 21627$

$y = 66.84$

$x^2 = 21839801$

$y^2 = 205.3$

$xy = 66452.4$

r = correlation factor

$n = 22$, sample size

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\left\{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]\right\}^{\frac{1}{2}}} = \frac{16404}{24996} = .65$$

$$t = r\left\{\frac{(n-2)}{(1-r^2)}\right\}^{\frac{1}{2}} = .65\left\{\frac{20}{.57}\right\}^{\frac{1}{2}} = 3.85$$

A t of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we reject the hypothesis:

Total SAT scores are related to the graduating GPA of engineering students.

Hypothesis 4

Grades in college mathematics are not related to the graduating GPA of engineering students:

Independent variable: x = Grades in college math

Dependent variable: y = Graduating GPA

Revised Sample Size: 27

Statistical method: Pierson linear correlation

Statistical test: t statistic, to 98% confidence

$x = 70.63$

$y = 78.94$

$x^2 = 196.83$

$y^2 = 234.71$

$xy = 211.82$

r = correlation factor

$n = 27$, sample size

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]} = \frac{143.61}{185.53} = .77$$

$$t = r\left\{\frac{(n-2)}{(1-r^2)}\right\}^{\frac{1}{2}} = .77\left\{\frac{25}{.40}\right\}^{\frac{1}{2}} = 6.08$$

A t of 2.52 is used for a 2 toil test at 98% confidence, therefore we reject the hypothesis:

Grades in college mathematics are related to the graduating GPA of engineering students.

Hypothesis 5

The combined effect of total SAT scores and grades in college mathematics are not related to the graduating GPA of engineering students:

Independent variable:	College math grades Total SAT scores
Dependent variable:	Graduating GPA
Statistical method:	Multiple correlation
ra:	Correlation factor, math grades to GPA
rb:	Correlation factor, total SAT scores to GPA
rc:	Correlation factor, total SAT scores to math grades
rd:	Multiple correlation factor, total SAT scores/grades in math, to GPA

$ra = .77$

$rb = .41$

$rc = .1$

$$rd = \left[\frac{(ra)^2 + (rb)^2 - 2(ra)(rb)(rc)}{1 - (rc)^2}\right]^{\frac{1}{2}}$$

$$rd = \left[\frac{(.77)^2 + (.41)^2 - 2(.77)(.41)(.1)}{1 - (.1)^2}\right]^{\frac{1}{2}} = \left[\frac{.697}{.99}\right]^{\frac{1}{2}} = .84$$

The multiple correlation factor of .84 is significant, therefore we reject the hypothesis:

The combined effect of total SAT scores and grades in college mathematics is related to the graduating GPA of engineering students.

Hypothesis 6

Mathematics scores on SAT tests are not related to the student's grades in college mathematics.

Independent variable: x = SAT math scores

Dependent variable: y = grades in mathematics

Revised Sample Size: 22

Statistical method: Pierson Linear Correlation

Statistical test: t statistic, to 98% confidence

$x = 11975$

$y = 61.38$

$x^2 = 6653990$

$y^2 = 178.77$

$xy = 33485.8$

r = correlation factor

$n = 22$

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]} = \frac{1662.1}{22229.8} = .075$$

$$t = r\left\{\frac{(n-2)}{(i - r^2)}\right\}^{\frac{1}{2}} = .075\left\{\frac{20}{.994}\right\}^{\frac{1}{2}} = .34$$

A t of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we accept the hypothesis:

SAT math scores are not related to the college math grades.

Hypothesis 7

Total SAT scores are not related to the student's grades in college mathematics.

Independent variable: x = Total SAT scores

Dependent variable: y = Grades in mathematics

Revised Sample Size: 22

Statistical method: Pierson Linear correlation

Statistical test: t statistic, to 98% confidence

$x = 21627$

$y = 61.38$

$x^2 = 21839801$

$y^2 = 178.77$

$xy = 60561$

r = correlation factor

$n = 22$

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\left\{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]\right\}^{\frac{1}{2}}} = \frac{4876.7}{45919.5} = .10$$

$$t = r\left\{\frac{n-2}{1-r^2}\right\} = .1\sqrt{\frac{20}{.99}} = .45$$

A t of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we accept the hypothesis:

Total SAT scores are not related to the college math grades.

Hypothesis 8

Verbal scores on SAT tests are not related to the student's grades in college mathematics.

Independent variable:	x = SAT verbal scores
Dependent variable:	y = Grades in college math.
Revised Sample Size:	21
Statistical method	Pierson Linear correlation
Statistical test:	t statistic, to 98% confidence

$x = 9380$

$y = 58.38$

$x^2 = 4411504$

$y^2 = 169.77$

$xy = 26248$

r = correlation factor

$n = 21$

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\left\{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]\right\}^{1/2}} = \frac{3603.6}{27035} = .13$$

$$t = r\left\{\frac{n-2}{1-r^2}\right\}^{\frac{1}{2}} = .13\left\{\frac{19}{.98}\right\}^{\frac{1}{2}} = .57$$

A t of 2.52 is needed for a 2 toiled test at 98% confidence, therefore we accept the hypothesis:

Verbal SAT scores are not related to the college math grades.

SUMMARY OF RESULTS

SAT math scores to college math grades :	.075
Total SAT scores to college math grades :	.100
SAT verbal to college math grades :	.130
SAT math scores to GPA :	.410
Total SAT scores to GPA:	.650
SAT verbal scores to GPA :	.690
College math grades to GPA :	.770
College math grades/SAT math grades : to GPA	.840

correlation factor, r

Hypotheses outcome:

1) SAT math scores are not related to graduating GPA ----- accept.

2) SAT verbal scores are not related to graduating GPA ---- reject.

3) Total SAT scores are not related to graduating GPA ----- reject.

4) College math grades are not related to graduating GPA --- reject.

5) Total SAT scores/grades in math. are not related to graduating GPA --- reject.

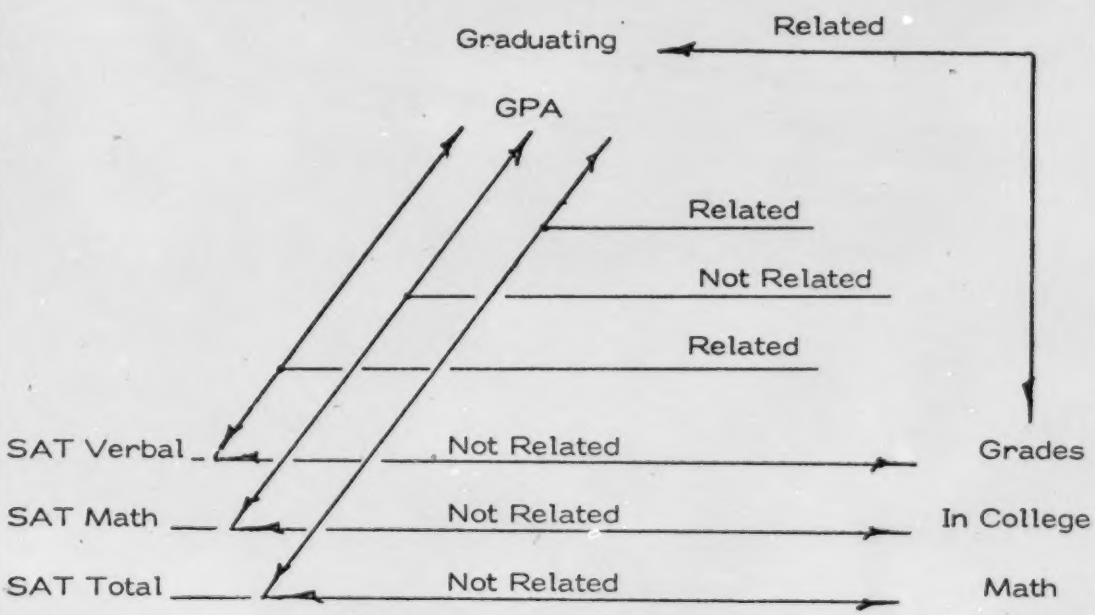
6) SAT math scores are not related to grades in math ----- accept.

7) Total SAT scores are not related to grades in math -----accept.

8) Verbal SAT scores are not related to grades in math ---- accept.

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

The diagram shown below visually summarizes the results of this study:



SAT Math Scores and College Math

There is a complete rejection of any relationship between SAT scores and student performance in college mathematics.

However, there is a strong relationship between the engineering student's performance in college mathematics and his graduating grade point average.

The first conclusion, therefore, is that selection of engineering students on the basis of a minimum SAT math score of 400, which is the present policy at the University, is not valid.

There must be some lower limit on the SAT mathematics scores, below which would strongly indicate that the student could not pass the college mathematics program, but is isn't 400. Data is not available to establish a realistic low limit since students with SAT math scores below 400 are denied admission. However, one student of the 30 graduates that represented the data for this study, did have an SAT math score of 370. His average grade in college math was 2.8 and he graduated with a 2.8 GPA. The indication is that some students, those who would score below 400 on the SAT math test, would do well in engineering, but are denied admission to the College.

SAT Verbal Scores and Success in the Engineering College

SAT verbal scores are related to success in the School of Engineering.

Admission policy at the University specifies a minimum of 400 in the SAT math test and a minimum of 700 on the total SAT score. The policy doesn't mention the verbal score. Therefore, a student with an SAT math score of 500 and a verbal of 200 would apparently be admitted to the engineering colleg.

Relative to the data used in this study, the lowest SAT verbal score

was 272.

Total SAT Scores and Graduating GPA

There is a relationship between the student's total SAT score and his graduating GPA. This is to be expected and corresponds to results by other investigators.

SAT Verbal and Total Scores in Relation to Grades in College Math

SAT verbal and total scores, along with SAT math scores are not related to the student's performance in college math.

One reason for the non-association is the proposition that SAT scores generally reflect the student's overall ability to handle an entire college program, not necessarily two or three specific courses.

Also, the student's anxiety level and degree of disturbance play a significant role in his effort to handle the engineering mathematics program successfully. The grade he receives may not reflect his true ability. It does, however, seem apparent that the student's temperment and his academic climate in the mathematics program sets his pattern for the remainder of his engineering education, since the grades he receives in his mathematics education are highly correlated to his graduating GPA. The student's ability may be higher than his math grades indicate, but the grade seems to indicate the degree of mastery he attained in the math courses.

The apparent reason for the high correlation between the student's math grades and his graduating GPA is the fact that junior and senior engineering courses are highly math oriented.

RECOMMENDATIONS

At the present time, admission to the school of engineering is based on a minimum SAT math score of 400 and a minimum total SAT score of 700.

Within the present framework of admissions, the following facts, uncovered by this study, are alive and functioning:

Fact A: SAT math scores are not related to the engineering student's college grades in math or to his graduating GPA.

Fact B: SAT verbal scores are related to the engineering student's graduating GPA.

Fact C: SAT total scores are related to the engineering student's graduating GPA.

A new interim policy on admissions is recommended. The proposed policy:

Admit on the basis of a minimum total SAT score of 650, with 350 as a minimum requirement in the math portions of the SAT tests.

RATIONALE

SAT math score: The recommendation is to lower the minimum

requirement from 400 to 350. If the student has the motivation to study engineering, let him enter the college math program. Since SAT math scores are not related to college math grades, or to the graduating GPA, there is a strong possibility that the students who score between 350 and 400 will be as successful, or unsuccessful, as students who score in the low 400 range, and the lower score of 350 will open the door to potentially successful students who, under present policy, would be denied admission.

The first college level math course, Calculus I, should tell the student, and counselling, where he stands relative to probable success in the engineering curriculum.

Corrective action, relative to poor performance in Calculus, seldom works. One reason for the failure of remedial action is that the remedy available is largely restricted to repeating the course. The remedy is simply a repetition of the same educational structure that initially rejected the student.

If the student flunks Calculus I, the recommendation is to advise the student to leave the engineering major. He will not be able to survive in the present educational structure at the University. He is wasting his money and time.

Relative to the nature of the engineering school at the University, the mathematics program is doing a good weeding job. This study shows that students who do poorly in mathematics also do poorly in the major engineering curriculum. The opposite is also true--students who do good in math can be expected to do well in the major engineering curriculum.

The recommendation is interim. A minimum SAT math score of 350 may be too low. A "break" point exists somewhere between a score of 200 and 400. We don't know where that break point is located, but we can assume that below that point, the student's degree of numerical literacy is too low for college work, regardless of his motivation or developing study habit.

X 200

Students with SAT math scores between 350 and 400 should be admitted to the engineering program. Their performance should be watched carefully. Relative to their performance, the minimum SAT math score may be revised via experience.

SAT verbal scores: This study found a high correlation between SAT verbal scores and success in the overall engineering curriculum. However, there is no relationship between SAT verbal scores and college math grades.

At present, the admission policy will enter a student via an implied

verbal minimum of 300. This investigation gives no indication that the present minimum of 300 should be changed. Ten percent of the engineering graduating class that provided the data for this study, had verbals below 300, while eighteen percent were below 350. Those students who scored below 300 on the SAT verbal, graduated with a 2.5 average GPA.

There doesn't seem to be any compelling evidence to lower or raise the verbal low limit of 300.

Total SAT scores: The total SAT minimum requirement would be subordinate to the minimum requirements for the math and verbal tests. In other words, the total minimum score would be 650, the sum of the minimum scores in the math and verbal tests.

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